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HOW FOURTH INDUSTRIAL REVOLUTION SKILLSETS MEDIATE THE RELATIONSHIP BETWEEN WORK INTEGRATED LEARNING, GRADUATE EMPLOYABILITY, AND FUTURE JOB

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Abstract

The emerging work context of the fourth industrial revolution (4IR) has increased the industry's calls for future-capable graduates who can demonstrate digital literacy and innovation knowledge, and other behavioural competencies for employability. Gaps between work integrated learning (WIL) and 4IR competencies in driving graduates' transition to the employment of the future exist in the literature. With a structural equation modelling (SEM) approach, this study examines the nexus between WIL, graduate employability, and future job. It further examines whether 4IR skillsets can boost (mediate) the effectiveness of WIL in enhancing graduate employability. With a correlational non-experimental research design, 375 engineering students from two universities in Nigeria were sampled. A composite-based SEM, comprising measurement and structural assessment model, was used to test the hypothesized model, implemented in SmartPLS software version 3.3.3. The instrument's validity and reliability were established through hetero trait – Mono trait ratio and average variance extracted. The structural model analysis rejected three hypotheses, testing direct relationships between WIL, graduate employability, and future job. Findings showed that WIL had a positive and significant relationship with graduate employability, 4IR skillset, and future job. It was established, that the 4IR skillset plays a considerable role and positively mediates the relationship between WIL and graduate employability. The study offers important insights on WIL as a strategy for developing graduate employability to prepare students for employment in the digital era.

Keywords: Work integrated learning, 4IR skillset, Graduate employability, future job, structural equation modelling.

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1. Introduction

The emergence of the fourth industrial revolution (4IR) amidst unemployment challenges and grim, facing graduates in securing a life-long career, is one of the major academic discourses in recent times. Before the 4IR, higher education providers with government institutions have identified gaps in the educational system and found lack of or inadequate skills as the bane of graduate unemployment globally [1, 2]. The fourth industrial revolution paradigm has altered learning and production systems due to the import of digitalization into industrial activities [3]. According to the World Economic Forum (WEF) report and other related studies, 4IR, digitalization, and automation will significantly impact individuals' immediate and future careers [4, 5]. Hirschi [6] emphasized that this development will change the basis of employment and ways of doing business; thus, new competencies and skills will be required for jobs in the digital era. Given the above, studies have suggested that the current higher institution of learning curriculum must include the acquisition of essential 4IR skillsets, such as artificial intelligence and basic programming knowledge [3, 5].

Besides the exigency of graduate unemployment, employers have repeatedly shown concern about the acute shortage of employability skills among early entry-level job applicants, including graduates of higher institutions of learning [7]. According to the literature, there are discrepancies in the expectation of employability skills between higher education graduates and industry due to the emergence of the fourth industrial revolution [8, 9]. Therefore, the 4IR and its technological know-how could further exacerbate the incidence of low employability skills among graduates. Mainstreaming the acquisition of fourth industrial revolution skillsets into higher education curriculum would be beneficial to graduates in seeking future employment. Documented evidence from the literature shows that higher education graduates have difficulties, securing employment in the digital era, as available jobs in the 21st-century require candidates with fourth industrial revolution competencies [3, 10, 11]. Studies also revealed that digital literacy and other essential soft skills enhance employability and work readiness, enable graduates to compete in the labor market, and promote a successful life-long career [1, 2].

Consequently, higher education graduates might be unable to contribute to the industry 4.0 economy and the society productively unless equipped with digital literacy and 4IR skillsets. The fourth industrial revolution skills are quite challenging for students to acquire, given the current curriculum in operation; this is understandable since not every student is in the university to study technology-related courses. According to Rahmat, Adnan, and Mohtar [12], higher education students' failure to acquire the fourth industrial revolution skillsets may lower graduates' career readiness and employability in the digital era. Therefore, a higher education student who lacks digital literacy skills may be considered not work-ready for a future career, thus finding it difficult to access the job market to secure future jobs. As identified by Suarta et al. [13], one of the main barriers to higher education students, entering the current labour market, characterized by digitalization and automation, is the gap between the graduate job skills and the skill, needed by the employers. The complexity of the 21st-century workplace, featuring augmented industry, raises concerns about the availability of future-capable graduates, equipped with competencies of industry 4.0. The current and future development of 4IR will impact the employment opportunities of graduates. The use and usability of the technologies of 4IR, which are capable of transforming the workplace [14], will have implications for today's students and future graduates, especially in terms of employability.

Studies have suggested that curriculum reversal is eminent in higher education due to gaps, identified between higher education graduates' capabilities and employers' expectations [15]. High academic performance in subjects and degrees is no longer sufficient as graduates need to equip themselves with occupational-specific skills to meet the need of the current labour market. Workers, including students, transitioning from higher education, need to be agile and equipped with employability skills critical for an effective transition to a 21st-century workplace. Competencies, such as critical thinking and analytical skills, creativity, teamwork, and digital literacy, have been acknowledged as essential to graduate employability and future career [12, 16].

Over the last decades, several initiatives to improve higher education students' work readiness and employability have emerged. Prominent among the initiatives is the work integrated learning (WIL) programme. Higher education providers partner with industry and communities to provide authentic and practical learning to the students [17, 18]. Work integrated learning is a general term to denote students' engagement in work-based learning, internship, clinical experience, practicum (teaching practice), and project-based learning [17]. WIL is designed to equip students with practical and technical expertise that may be difficult to acquire during classroom learning. The purpose is to compliment skill shortfalls and improve student capability in line with the expectation of employers in an actual work situation. The adoption of work integrated learning to enhance graduate employability has become imminent due to its benefits to students, primarily in terms of critical skill acquisition [3, 10]. Work integrated learning is a collaborative partnership between industry and higher education institutions, an outcome-based learning activity to improve students' capacity to be work-ready [11, 17]. According to Kay et al. [3]; Jackson [17]; Okeke-Uzodike and Anwana [19], WIL is a student-centered approach, in which learning shifts from content-based to life-long-based. The purpose is to align learning to what students ought to know and demonstrate to cope beyond the educational environment.

Work-integrated learning is beneficial to developing graduates' employability. The 21st-century workplace, in which the fourth industrial revolution technologies are creating skill gaps, may reduce the efficacy of WIL as a tool for developing graduate employability. Although WIL can be valuable in developing essential skills for graduates, the current reality suggests that without digital literacy and 4IR skillsets, competencies, acquired through work-integrated learning, may not be sufficient to guarantee future jobs for graduates. Against this backdrop, the current study addresses the following questions: i) To what extent is work integrated learning preparing graduates' acquisition of employability skills? ii) Does work integrated learning enhance students' preparedness for future jobs? iii) To what extent do fourth industrial revolution skillsets influence the relationship between work integrated learning and graduates' employability?. Therefore, to this extent, this study provides insight into whether work integrated learning can be used to prepare and acquire employability skills and further enhance graduates' capabilities to secure future jobs. The study also examines whether the availability of 4IR skillsets and other essential competencies, gained through the WIL programme, can boost graduate employability.

The current socio-economic transformation, orchestrated by the fourth industrial revolution, has increased how higher education providers respond to preparing graduates, who are expected to navigate the complex and challenging employment context [6, 11, 17]. The task of training graduates in the diverse and technological-driven labour market has translated into a broad institutional approach to graduate employability [16, 20]. Many studies have described the features of graduate employability to include the development of generic and professional skills and capabilities for work readiness, career self-management, and network learning [1, 14]. The fourth industrial revolution (4IR) transforms all facets of human endeavour, bringing unprecedented transformation into society's socio-economic and political fabric [21]. The revolution is characterized by technological innovation and advanced robotics [22]. The 4IR and its technologies have equally impacted employment; the skills and competencies, demanded of jobs, are distinct from previous revolutions [23]. Studies have emphasized that the fourth industrial revolution will increase the demand for professional and technologically inclined skills [24]. Still, the revolution will also put further pressure on higher education in terms of skill expectations from students after graduation [22, 24, 25].

According to Abdullah, Humaidi and Shahrom, [26]; Potts [27]; Rahmat [12], the current global rise in graduate unemployment can be attributed to the lack of fourth industrial revolution skills and competencies; thus, developing work competencies, paralleled with 4IR challenges, becomes essential. Maria, Shahbodin and Pee, [28] suggested that since the 4IR has increased the demand for highly qualified candidates for jobs, the higher education providers as the producer of skilled human resources need to adjust the way students are trained to close the skill gap. Accordingly, training in line with the 4IR skillset will prepare the students and qualify them for future employment in the digital era [28]. Theoretically, Kolb's [29] experimental theory holds that work integrated learning is beneficial to enhancing skill outcomes and preparing for employment and perceived employability. The theory concluded that students acquire knowledge and skills through active engagement in practical and structural activities by applying their theoretical knowledge and making sense of their experience to inform future development.

Regarding the development of employability skills, work integrated learning is widely recognized as a direct pathway to acquiring global work experience and preparing students for future jobs [27, 30]. Studies have established that despite obvious challenges and complexity in evaluating the contribution of WIL in developing skills, needed by employers, there is evidence that experimental learning augments students' skills [20, 31]. As a practical-based and experimental-learning approach, WIL enhances different dimensions of graduate employability. Studies, conducted by Ayoubi et al. [32], Pheko and Molefhe [33], found that work integrated learning has considerable influence on employability competencies, such as communication skills, analytical and critical thinking skills, interpersonal skills, among others. Based on the outcomes from these studies, the proposition that work integrated learning is strongly related to graduate employability is further reinforced. Pitan and Muller [25], in their studies, also reiterate that work integrated learning enhances students' career expectations, professional networks, and ability to take the initiative and improve leadership attributes.

Work integrated learning is grounded in experimental, work-based, and cooperative education. Internship placement, fieldwork, practicum, clinical, and student industrial work experience are all forms of work integrated learning [17, 18]. The term is generally linked with all students' industrial work experience scheme (SIWES) activities in Nigeria. Students can learn and acquire practical experience in a typical work environment in addition to classroom learning. WIL mainly involves three stakeholders: i) students, ii) employers, and iii) higher education providers. The essence of WIL is to enable students to acquire hands-on experience in future work contexts to develop generic and professional competencies for employability [34]. Beraza [14], Kay et al. [18], Rowe and Zegwaard [31] studies revealed that there is a strong connection between graduate employability and work integrated learning. According to Patrick et al. [34], work integrated learning is a comprehensive approach to acquiring authentic experience. Students engaged in learning with industry or community partners to apply knowledge and skills within the work context. Accordingly, the experience, gained through engagement in work integrated learning, is vital in supporting the student to secure employment. Govender and Adegbite [10] stated that WIL increases the fit between workplace requirements and educational outcomes, thus, increasing the capabilities and enhancing students' chances to secure employment after graduation. A similar study, conducted by Zamandaba [35], found that WIL increases self-reflection and helps students understand their training needs and acquire skills to enhance their future employment opportunities.

A successful work integrated learning programme is a panacea to several outcomes, including improved academic performance and future employment [10, 11]. The potential benefits of WIL in preparing students for life after graduation is well documented in the literature. However, there is less effort by the academic community in interrogating and measuring the relationship between work integrated learning and the fitness of graduates for future employment. Adegbite and Adeosun [3] found a discrepancy between available skills and skills, required for future jobs, among many school leavers. When fully adopted, the fourth industrial revolution technologies will enable new ways of executing work, bringing new opportunities for value creation to businesses and organisations [6, 9]. Without being pessimistic, the fourth industrial revolution is transforming the manufacturing processes and how workers are expected to perform their tasks using computer-enabled robots and other machines to drive production. Therefore, higher education graduates will have to acquire skills relevant to the organization, operating in the 4IR era. Rahmat et al. [12] emphasized that the failure of higher education providers to close the gap between the current skills and the anticipated future skill demand may further increase the incidence of low and lack of employability skills among graduates. It is unclear whether most students are career-ready for the 4IR workplace because organisations are demanding a mixture of skills, including fourth industrial revolution skillsets. Jackson & Brigdstock [20]; Rowe & Zegwaard [31] studies revealed that students who participated in work integrated learning were more employable than those who did not engage in WIL. The studies emphasized that such students demonstrate a better understanding of required skills standards and the ability to perform effectively in the workplace.

The literature is inundated with several arguments on the impact of work integrated learning on graduate employability [15, 18, 32]. There is, however, mixed evidence to support the premise that work integrated learning automatically enhances the development of employability among graduates. Many argued that WIL could only contribute little and make a minor difference in transitioning skills from the classroom to the workplace. WIL enables students to discover their talent beyond disciplinary expertise, thus, enhancing graduate employability [11, 16, 19, 20, 31]. Reviews from the extant literature, discussed above, confirmed the causality between work integrated learning and graduate employability. Also presented was how important the fourth industrial revolution skillset and competencies could support graduates to improve their employability skills and secure future employment in the 21st-century workplace.

Based on the above, a model, concerning the impact of the work integrated learning experience on graduate employability, future job, and fourth industrial revolution skillset, was designed using partial least square (PLS) structural equation modeling (SEM). SEM (composite-based or variance-based) is a causal modeling statistical technique to maximize explained variance of latent dependent variables [36]. The method (PLS-SEM) is remarkable and valuable in identifying relationships between constructs. Thus, this study adopted the technique to examine work integrated learning and the fourth industrial revolution skillset implication on graduate employability and future job. To this end, four hypotheses were proposed to explore the relationship between work integrated learning, graduate employability, and future job.

Ho_1: Work integrated learning does not positively and significantly enhance graduate employability

Ho_2: Work integrated learning does not positively and significantly enhance the ability of graduates to secure future jobs

Ho_3: Work integrated learning does not positively and significantly enhance the fourth industrial revolution skillset among the engineering students

Ho_4: Fourth industrial revolution skillset does not positively mediate the relationship between work integrated learning and graduate employability

Based on the foregoing, this research aimed to examine the relationship between work integrated learning and graduate employability using university students.

2. Materials and Methods

Research Design, Population, and Sample

This study aimed to create a structural equation model (SEM) that depicts causality between work integrated learning and graduate employability. Furthermore, the model also attempts to establish whether acquiring the fourth industrial revolution skillset can boost the relationship between WIL and graduate employability. This is a correlational study, in which a multivariate quantitative approach was used. In this study, students were the unit of analysis. The target population was students, pursuing bachelor's degrees in the university who participated in the WIL programme during their studies. Data was collected between July and December 2021. Participants were informed about the purpose of the research. All participants consented and voluntarily participated in the research. Three hundred seventy-five (375) respondents were drawn from the final-year engineering students from two universities in the southern part of Nigeria. The data revealed the age of the students, ranged from 16 and 31 years. Seventy-two (72), representing 19.2 % of the students, were female, while 303 (80.8 %) were male. Barcklay, Thompson and Higgins's [37] sample size determination method was used to determine the minimum sample size for the study. Therefore, the construct with the highest indicators was used to arrive at a minimum sample of 100 (i. e., 10 x 10=100). Based on the sample size technique adopted, the 375 students that participated in the study were sufficient to test the hypothesized model. In this study, data was gathered through a researcher-developed questionnaire. Four (4) constructs, 13 sub-constructs, and 82 indicators were used in the SEM model. Using a multivariate approach (non-parametric), ordinary least square path modeling, implemented through SmartPLS software, was used to test the hypothesized model. According to Wold [38], measuring latent variables (direct or indirect relationship) is best implemented using a partial least square path modelling approach. This is because a latent construct cannot be measured directly; instead, it can only be observed through indicators.

Instrument and Measures

A modified questionnaire, titled work integrated learning experience (WILE), fourth industrial revolution skillsets (F4IR), employability (EM), and future job (FJB) scales were used in this study. Items from Al-Alawneh [39]; Jonck and Minner [40]; Suarta et al. [13] were adapted and modified to measure work integrated learning and graduate employability. Similarly, items, used in previous studies i. e., [2, 3, 5), were adapted and modified to measure the future job and fourth industrial revolution skillsets. Using a five-point Likert scale, 50 indicators were used to measure graduate employability. The scale ranges from 1=Very low to 5=Very high. In the same vein, with a five-point Likert scale, ranging from 1=Never to 5=Very often, ten (10) item indicators, were used to measure the WIL experience of the students. Three sub-constructs (digital literacy knowledge, life and career knowledge, and learning and innovation knowledge), comprising 16 item indicators, were used to measure the fourth industrial revolution skillset. A five-point Likert scale with the options, ranging from 1=Very low to 5=Very high, was used to elicit responses from the participants on the 4IR skillset. Five (5) item indicators with options, ranging from 1=Strongly disagree to 5=Strongly agree, were used to measure the students' prospects for future jobs. The content validity index (0.73, 0.77, 0.71 and 0.71) and ordinal alpha reliability coefficient (0.84, 0.80, 0.86

and 0.89) were established for the four instruments respectively. The current study used the partial least square (PLS) structural equation modelling (SEM) approach, implemented in SmartPLS, to analyze the study's data.

3. Result

Due to its popularity and wide acceptability, PLS path modelling was used for data analysis in this study. The choice of the approach was based on the premise that the technique has become the most appropriate tool to predict the relationship between the exogenous and endogenous latent variables [36]. **Table 1** presents the descriptive statistics of all indicators in the study, showing the mean, standard deviation, excess kurtosis, and skewness.

Table 1

Descriptive Statistics on Indicators, used in PLS-SEM (N=375)

Indicators	Missing	Mean	Median	Min	Max	Standard Deviation	Excess Kurtosis	Skewness
1	2	3	4	5	6	7	8	9
WILE1	0	3.688	4	1	5	1.028	–0.121	–0.602
WILE2	0	3.755	4	1	5	1.019	–0.242	–0.556
WILE3	0	3.709	4	1	5	1.072	–0.501	–0.52
WILE4	0	4.056	4	1	5	0.985	0.39	–0.936
WILE5	0	2.544	2	1	22	1.629	52.706	4.654
WILE6	0	3.587	4	1	5	1.203	–0.603	–0.555
WILE7	0	4.024	4	1	5	1.039	0.682	–1.051
WILE8	0	3.611	4	1	5	1.045	–0.522	–0.366
WILE9	0	3.504	4	1	5	1.09	–0.279	–0.469
WILE10	0	3.72	4	1	5	1.045	–0.259	–0.518
FJB1	0	3.613	4	1	5	1.013	0.281	–0.697
FJB2	0	3.616	4	1	5	0.989	0.239	–0.632
FJB3	0	3.731	4	1	5	1.068	0.478	–0.923
FJB4	0	3.667	4	1	5	1	0.209	–0.689
FJB5	0	3.749	4	1	5	1.002	0.598	–0.855
EM_FS1	0	3.285	3	1	5	1.096	–0.259	–0.352
EM_FS2	0	3.488	3	1	5	0.968	–0.029	–0.329
EM_FS3	0	3.565	4	1	5	0.996	0.04	–0.441
EM_FS4	0	3.744	4	1	5	0.993	0.311	–0.635
EM_FS5	0	3.741	4	1	5	1.046	0.098	–0.662
EM_FS6	0	3.755	4	1	5	1.032	–0.118	–0.518
EM_CS1	0	3.429	3	1	5	1.038	–0.096	–0.328
EM_CS2	0	3.571	4	1	5	0.966	–0.127	–0.37
EM_CS3	0	3.603	4	1	5	0.993	0.211	–0.532
EM_CS4	0	3.851	4	1	5	0.912	0.143	–0.548
EM_CS5	0	3.832	4	1	5	0.924	0.02	–0.514
EM_CS6	0	3.773	4	1	5	0.977	0.156	–0.567
EM_AC1	0	3.568	4	1	5	1.017	0.022	–0.43
EM_AC2	0	3.757	4	1	43	2.247	248.629	14.205
EM_AC3	0	3.749	4	1	5	0.886	0.406	–0.457
EM_AC4	0	3.781	4	1	5	0.958	0.359	–0.629
EM_AC5	0	3.816	4	1	5	0.947	0.055	–0.514
EM_AC6	0	3.795	4	1	5	0.973	0.117	–0.572
EM_ME1	0	3.752	4	1	5	1.007	–0.096	–0.511
EM_ME2	0	3.851	4	1	5	0.99	0.427	–0.772
EM_ME3	0	3.925	4	1	5	0.991	0.458	–0.825
EM_ME4	0	3.971	4	1	5	0.922	–0.159	–0.577
EM_ME5	0	3.789	4	1	5	0.986	0.257	–0.641
EM_ME6	0	3.941	4	1	5	0.945	–0.024	–0.606

Continuation of Table 1

1	2	3	4	5	6	7	8	9
EM_ME7	0	4.059	4	1	5	0.962	0.47	–0.877
EM_IS1	0	3.616	4	1	5	0.973	0.392	–0.548
EM_IS2	0	3.8	4	1	5	0.941	0.092	–0.575
EM_IS3	0	3.805	4	1	5	0.956	0.48	–0.705
EM_IS4	0	3.696	4	1	5	0.982	–0.019	–0.447
EM_IS5	0	3.896	4	1	5	0.896	–0.131	–0.464
EM_IS6	0	3.797	4	1	5	0.975	0.24	–0.624
EM_RM1	0	3.515	3	1	5	0.974	0.411	–0.467
EM_RM2	0	3.576	4	1	5	0.993	–0.223	–0.335
EM_RM3	0	3.731	4	1	5	0.926	0.141	–0.39
EM_IU1	0	3.488	3	1	5	1.004	–0.001	–0.348
EM_IU2	0	3.587	4	1	5	0.942	–0.173	–0.242
EM_IU3	0	3.685	4	1	5	0.881	–0.202	–0.234
EM_IU4	0	3.675	4	1	5	0.955	0.131	–0.433
EM_IU5	0	3.752	4	1	5	0.966	0.095	–0.52
EM_ICT1	0	3.477	4	1	5	1.136	–0.349	–0.465
EM_ICT2	0	3.427	3	1	5	1.159	–0.597	–0.378
EM_ICT3	0	3.509	4	1	5	1.136	–0.253	–0.599
EM_ICT4	0	3.485	4	1	5	1.075	–0.312	–0.388
EM_ICT5	0	3.483	4	1	5	1.114	–0.371	–0.421
EM_ICT6	0	3.717	4	1	5	1.017	–0.035	–0.525
EM_AS1	0	3.344	3	1	5	0.964	0.088	–0.215
EM_AS2	0	3.501	3	1	5	0.979	–0.367	–0.217
EM_AS3	0	3.592	4	1	5	0.964	–0.017	–0.379
EM_AS4	0	3.771	4	1	5	0.969	–0.094	–0.497
EM_PK1	0	3.365	3	1	5	1.005	–0.209	–0.276
EM_PK2	0	3.781	4	1	5	0.944	0.161	–0.582
F4IR_DLK1	0	3.381	3	1	5	1.041	–0.093	–0.429
F4IR_DLK2	0	3.123	3	1	5	1.132	–0.687	–0.243
F4IR_DLK3	0	3.261	3	1	5	1.086	–0.46	–0.271
F4IR_DLK4	0	3.296	3	1	5	1.091	–0.379	–0.299
F4IR_DLK5	0	3.2	3	1	5	1.129	–0.533	–0.232
F4IR_DLK6	0	3.229	3	1	5	1.148	–0.635	–0.213
F4IR_LIK1	0	3.317	3	1	5	0.945	0.089	–0.235
F4IR_LIK2	0	3.384	3	1	5	0.956	–0.043	–0.3
F4IR_LIK3	0	3.432	3	1	5	1.03	–0.144	–0.294
F4IR_LCK1	0	3.568	4	1	5	0.958	0.602	–0.597
F4IR_LCK2	0	3.629	4	1	5	0.943	0.098	–0.425
F4IR_LCK3	0	3.672	4	1	5	0.907	0.596	–0.574
F4IR_LCK4	0	3.725	4	1	5	0.907	0.508	–0.526
F4IR_LCK5	0	3.707	4	1	5	0.923	0.248	–0.487
F4IR_LCK6	0	3.84	4	1	5	0.933	0.299	–0.566
F4IR_LCK7	0	3.712	4	1	5	0.981	0.123	–0.52

Note: WILE= Work integrated learning experience; FJB= Future job; EM_FS= Fundamental skill; EM_CS= Communication skill; EM_AC= Analytical & critical thinking skill; EM_ME= Moral & ethics skill; EM_IS= Interpersonal skill; EM_RM= Resource mobilization skill; EM_IU= Information use skill; EM_ICT= Information communication & technology skill; EM_AS= Adaptability skill; EM_PK= Professional knowledge; F4IR_DLK= Digital literacy knowledge; F4IR_LIK= Learning & innovation knowledge; F4IR_LCK=Life & career knowledge.

Measurement Model

The two stages (measurement and structural models), involved in structural and path modelling analysis, are presented in this study. First, the measurement model is the initial stage, in which the assessment of model fitness is carried out. The model assessment was established through indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, as recommended by Kock [41]. In this study, all constructs were measured reflectively; thus, arrows in the model point from the constructs to the indicators. The proposed measurement model was presented in **Fig. 1**, comprising both exogeneous and endogenous constructs. Accordingly, the exogenous construct is work integrated learning experience (WILE), while the endogenous constructs consist of graduate employability (EM), future job (FJB), and fourth industrial revolution skillsets (F4IR).

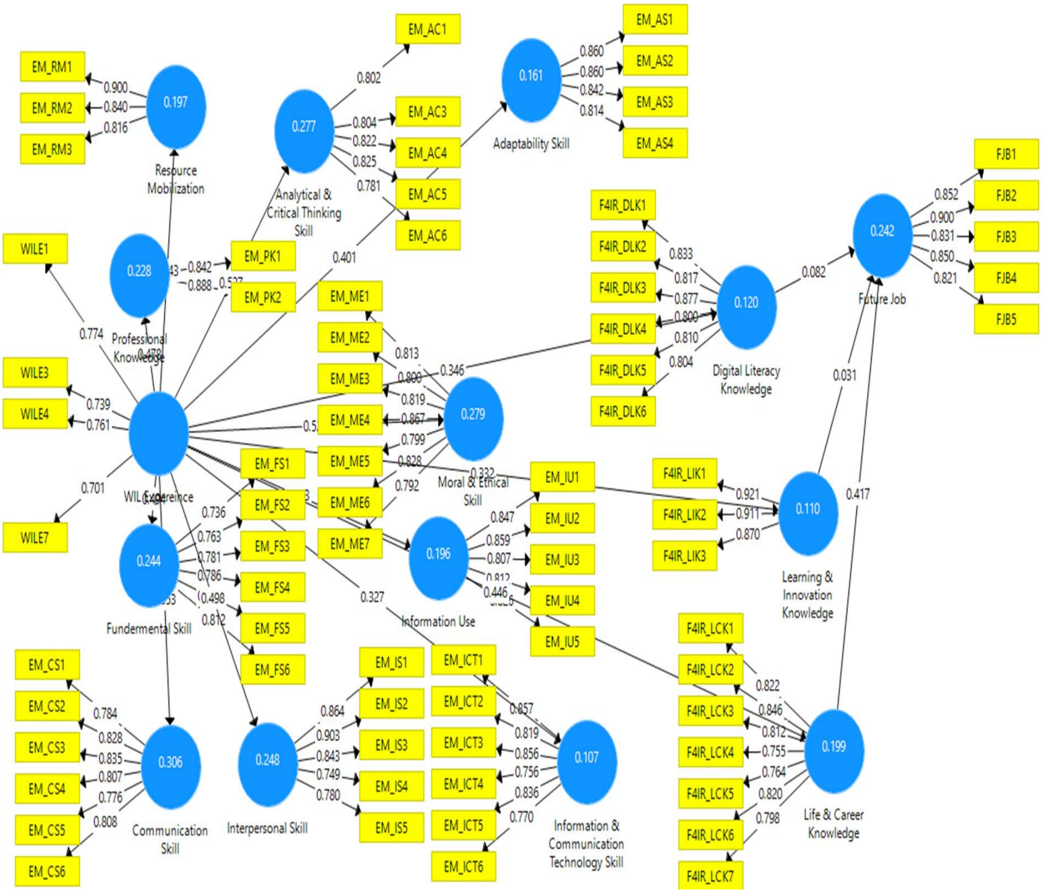

Fig. 1. Measurement Model

Indicators of Reliability and Internal Consistency

One of the crucial steps in PLS-SEM is to examine indicators' external loading and ensure the robustness of the instrument before testing the hypothesis. In this study, multiple instruments of the same construct were used; therefore, examining the strength, consistency, and closeness of items within the group becomes essential. As recommended by Hair Jr et al. [42], the rule of thumb is that the outer loading value of the indicator should be between 0.70 and 0.90. In this study, the outer loading values of all item indicators, used in the structural model analysis, were above 0.70. However, items, such as WILE2, WILE5, WILE6, WILE8, WILE9, WILE10, and EM_AC2 loadings, were less than 0.70, thus, considered weak, then deleted from the model. Therefore, the coefficient met the minimum threshold value of 0.70 for item reliability. Similarly, a composite reliability index test was conducted to establish that the instruments, used in the structural model, are reliable in terms of internal consistency. Hair et al. [42] suggested that the reliability coefficient of the construct should be between 0.70 and above. As shown in **Table 2**, the composite reliability index of all items in this study varied between 0.83 and .93, satisfying the minimum condition.

Table 2
Reliability and Convergent Validity of Measurement

Construct	Indicators	Indicator Reliability	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
1	2	3	4	5	6
Analytical & Critical Thinking Skill	EM_AC1	0.802	0.867	0.903	0.651
	EM_AC3	0.804			
	EM_AC4	0.822			
	EM_AC5	0.825			
	EM_AC6	0.781			
Adaptability Skills	EM_AS1	0.86	0.865	0.908	0.713
	EM_AS2	0.86			
	EM_AS3	0.842			
	EM_AS4	0.814			
Communication Skill	EM_CS1	0.784	0.893	0.918	0.651
	EM_CS2	0.828			
	EM_CS3	0.835			
	EM_CS4	0.807			
	EM_CS5	0.776			
	EM_CS6	0.808			
Fundamental Skills	EM_FS1	0.736	0.874	0.905	0.614
	EM_FS2	0.763			
	EM_FS3	0.781			
	EM_FS4	0.786			
	EM_FS5	0.821			
	EM_FS6	0.812			
Information Communication & Technology	EM_ICT1	0.857	0.90	0.923	0.667
	EM_ICT2	0.819			
	EM_ICT3	0.856			
	EM_ICT4	0.756			
	EM_ICT5	0.836			
	EM_ICT6	0.77			
Interpersonal Skills	EM_IS1	0.864	0.886	0.917	0.688
	EM_IS2	0.903			
	EM_IS3	0.843			
	EM_IS4	0.749			
	EM_IS5	0.78			
Information Use	EM_IU1	0.847	0.888	0.917	0.690
	EM_IU2	0.859			
	EM_IU3	0.807			
	EM_IU4	0.812			
	EM_IU5	0.826			
Moral and Ethics Skills	EM_ME1	0.813	0.917	0.934	0.668
	EM_ME2	0.8			
	EM_ME3	0.819			
	EM_ME4	0.867			
	EM_ME5	0.799			
	EM_ME6	0.828			
	EM_ME7	0.792			
Professional Knowledge	EM_PK1	0.842	0.812	0.856	0.749
	EM_PK2	0.888			
Resource Mobilization	EM_RM1	0.9	0.815	0.889	0.727
	EM_RM2	0.84			
	EM_RM3	0.816			

Continuation of Table 2

1	2	3	4	5	6
Digital Literacy Knowledge	F4IR_DLK1	0.833	0.908	0.927	0.679
	F4IR_DLK2	0.817			
	F4IR_DLK3	0.877			
	F4IR_DLK4	0.8			
	F4IR_DLK5	0.81			
	F4IR_DLK6	0.804			
Life & Career Knowledge	F4IR_LCK1	0.822	0.908	0.927	0.645
	F4IR_LCK2	0.846			
	F4IR_LCK3	0.812			
	F4IR_LCK4	0.755			
	F4IR_LCK5	0.764			
	F4IR_LCK6	0.82			
	F4IR_LCK7	0.798			
Learning & Innovation Knowledge	F4IR_LIK1	0.921	0.885	0.928	0.812
	F4IR_LIK2	0.911			
	F4IR_LIK3	0.87			
Future Job	FJB1	0.852	0.905	0.929	0.725
	FJB2	0.9			
	FJB3	0.831			
	FJB4	0.85			
	FJB5	0.821			
Work Integrated Learning	WILE1	0.774	0.731	0.832	0.554
	WILE3	0.739			
	WILE4	0.761			
	WILE7	0.701			

Convergent and Discriminant Validity

Hair Jr et al. [42]; Fornell and Lacker [43] recommended that the average variance extracted (AVE) value should be at least 0.50 and above to establish that a construct converged. The above suggests that the construct would be able to explain at least 50 % of the variance of its respective indicators. As shown in **Table 2**, all constructs achieved the minimum cutoff of AVE recommended. This study used the Fornell-Lacker criterion for discriminant validity to estimate the average variance, extracted from each variable's square root. The HeteroTrait-MonoTrait (HTMT) ratio was also used to establish the constructs' discriminant validity. Hensler et al. [44] stated that HTMT offers superior performance, compared with other methods of assessing discriminant validity. Gold, Malhotra, and Segars [45]; Hensler et al. [44] stated that discriminant validity is established when the HTMT value is less than 0.90. The HTMT values for all constructs in this study were less than 0.90, as shown in **Table 3**.

Table 3

Hetero Trait-Mono Trait (HTMT) ratio

	Construct	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
I	Adaptability Skill	–														
II	Analytical & Thinking Skill	0.675	–													
III	Communication Skill	0.681	0.607	–												
IV	Digital Literacy	0.605	0.614	0.555	–											

Continuation of Table 3

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
V	Fundamental Skill	0.637	0.826	0.852	0.628	–										
VI	Future Job	0.445	0.557	0.576	0.352	0.552	–									
VII	ICT Skill	0.628	0.671	0.682	0.688	0.622	0.444	–								
VIII	Information Use	0.64	0.786	0.732	0.597	0.743	0.507	0.711	–							
IX	Interpersonal Skill	0.651	0.827	0.763	0.523	0.763	0.52	0.624	0.791	–						
X	Learning & Innovation	0.59	0.669	0.635	0.75	0.609	0.413	0.618	0.628	0.57	–					
XI	Life & Career Knowledge	0.682	0.774	0.748	0.615	0.668	0.528	0.659	0.701	0.748	0.762	–				
XII	Moral & Ethical Skill	0.65	0.85	0.797	0.529	0.763	0.528	0.553	0.714	0.793	0.49	0.682	–			
XIII	Professional Knowledge	0.888	0.796	0.831	0.731	0.853	0.601	0.686	0.779	0.814	0.763	0.793	0.777	–		
XIV	Resource Mobilization	0.733	0.75	0.688	0.651	0.675	0.463	0.657	0.791	0.791	0.649	0.743	0.706	0.843	–	
XV	WIL Experience	0.504	0.65	0.68	0.381	0.612	0.649	0.398	0.539	0.616	0.401	0.537	0.642	0.682	0.558	–

Structural Model (**Fig. 2**)

Using 375 cases and 5000 bootstrapping estimates, as suggested by Hair et al. [36], this study confirmed the path coefficients' significance. This was to establish the causal relationship (direct and indirect). **Table 4** shows the path coefficient values, significant level, t-statistics, p-value, and bootstrapping at a 95 % confidence interval.

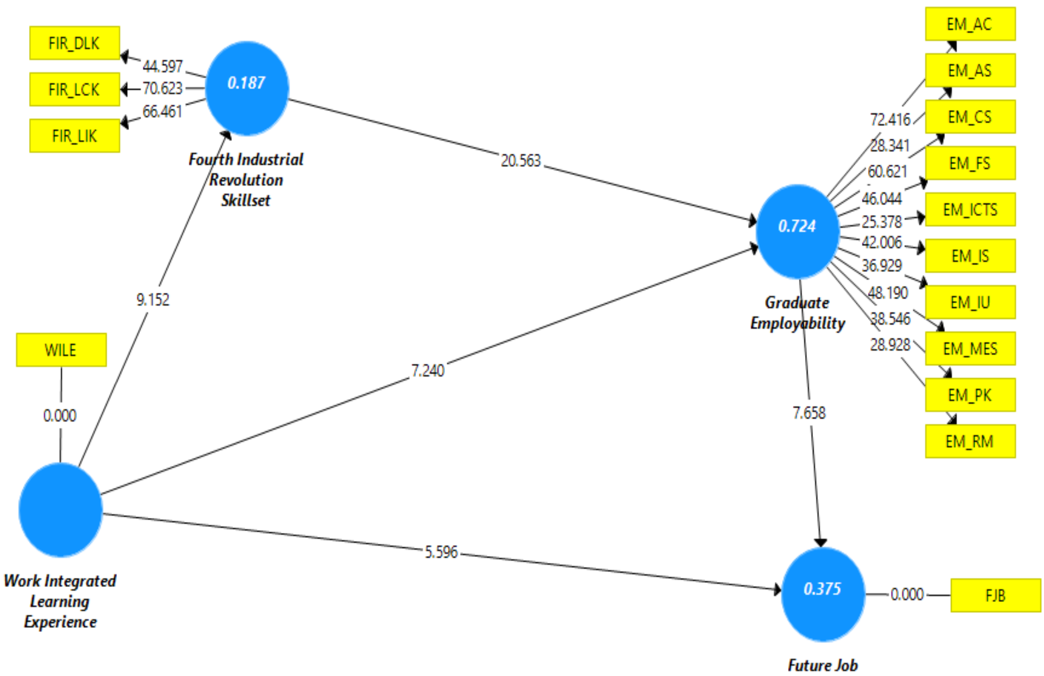

Fig. 2. Structural Model

Table 4 presents the extent of the models' relationship (i.e., direct and indirect relationships between constructs). Findings from the structural model indicate that work integrated learning positively and directly affects graduate employability (β=0.27, t=7.240, p<0.00). Thus, a positive and significant relationship between work integrated learning and graduate employability among engineering students sampled. Invariably, every unit increase in work integrated learning increases the employability readiness of the students by 27 % at 0.3 standard deviation. Furthermore, the results from the structural model showed that work integrated learning causes' the students' prospects for future jobs and fourth industrial revolution skillsets. Specifically, a unit increase in work-integrated learning experience will lead to a 30 % increase in student readiness for future employment (β=0.302, t=5.59, p<0.05). Also, the result from hypothesis three, testing whether there is a direct relationship between work integrated learning and the fourth industrial revolution, was positive. From the structural model of the SEM analysis, there was a significant and positive direct relationship (β=0.432, t=9.15, p<0.05) between WIL and 4IR skillset. With this finding, effective work integrated learning enhances the fourth industrial revolution skillset among the sampled students. The fourth hypothesis (Ho_4), proposing that fourth industrial revolution skillsets do not positively and significantly mediate the relationship between work integrated learning and graduate employability, was rejected. According to the result, fourth industrial revolution skillsets positively and significantly mediate (β=0.301, t=8.494, p<0.05) the relationship between work integrated learning and graduate employability. It implies that a unit increase in the number of fourth industrial revolution skillsets, gained by the students, will boost the relationship between work integrated learning and graduate employability by 30 %. Consequently, all the four hypotheses (Ho_1 - Ho_4), proposed and tested in this study, were rejected. In addition to the moderating effect, all paths, representing the relationships between WIL, graduate employability, future job, and fourth industrial revolution skillsets, were not negative. Therefore, the four null hypotheses were rejected, and the alternative hypotheses upheld.

Table 4
Path Coefficient in the Structural Model

Hypothesis	Constructs Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Bias	T Statistics (|O/STDEV|)	Sig	Remarks
Ho_1	WIL -> Graduate Employability	0.273	0.273	0.03	0.00	7.24	0.00	Reject
Ho_2	WIL -> Future Job	0.302	0.302	0.05	0.00	5.59	0.00	Reject
Ho_3	WIL -> 4IR Skillset	0.432	0.432	0.04	0.00	9.152	0.00	Reject
Ho_4	WIL -> 4IR Skillset-> Graduate Employability	0.301	0.301	0.03	0.00	8.49	0.00	Reject

4. Discussion

Compared to the conventional learning approach, work integrated learning can improve students' employability and enhance their readiness for future employment. The fourth industrial revolution presents new ways of how the factory operates; thus, the linkage between the higher education provider and industry must be strengthened to improve graduate understanding of the skill demand of the revolution. The importance of higher education providers in promoting the learning environment that exposes graduates to the actual work situation in readiness for the 21st-century workplace is inherent in the practice of work integrated learning. Considering the above, it becomes essential for the current study to examine the effect of work integrated leaning on specific outcomes, including employability and the future job of graduates. The study also investigates whether the fourth industrial revolution skillset will enhance work integrated learning effectiveness in boosting the students' capabilities and readiness for employment. This study confirmed the structural validity of the instrument, used to investigate the proposed hypotheses through the measurement model. With the variance extracted greater than 0,05, it suffices to conclude that the instrument adequately measured what it was designed to measure. Both composite reliability (CR) and Cronbach Alpha (CA) coefficients for measuring constructs consistency are greater than 0.70. Findings from the structural model showed that work integrated learning had a positive and significant relationship with graduate employability and future job. Similarly, the fourth industrial revolution skillsets, measured through digital literacy knowledge, learning and innovation knowledge, and life and career knowledge, were found to enhance the chances of work integrated learning in boosting its impact on graduate employability. The extant literature on graduate employability emphasized that the work integrated learning approach can provide a valuable opportunity and enable students to have insight into the actual workplace situation to acquire experience and competencies of the fourth industrial revolution [26]. The outcome of this study attests to Briant and Crowther [46] that work integrated learning introduces the students to industry standards. It further plays a vital role in connecting theory and practice for career development. Furthermore, the findings on the fourth industrial revolution skillset, enhancing the effectiveness and boosting the contribution of work integrated learning to graduate employability, has been documented in many studies. In the literature, few studies attempted to interrogate the link between fourth industrial revolution competencies, work integrated learning, and other important outcomes, such as graduate employability [4, 13]. However, our study laid credence to Okeke-Uzodike and Anwana [19] findings that work integrated learning is an enabler for students' preparedness in the fourth industrial revolution era. The above corroborated Yanew [47] conclusion that the needed skill transformation, required by the student in the digital era, can be attained through an effective work integrated learning programme.

This study was conducted among the engineering students in two universities in Nigeria; this is a major limitation against the generalization of the results. Therefore, further research is recommended, sampling students from other disciplines across many universities.

5. Conclusion

The study makes two significant contributions to knowledge. First, it affirms the value of work integrated learning for preparing higher education students for future jobs, particularly in enhancing their employability competencies and building essential skills for work readiness. Secondly, it identifies the importance of the fourth industrial revolution skillset as a panacea for effective work integrated learning in building students' capability for future employment, especially in the digital era. The study's structural equation modelling approach allows co-founding multiple indicators in measuring the exogenous and endogenous construct in a single model. Engineering students in the final year of their study from two universities who had participated in the work integrated learning programme provided the data, used in the predictive analysis; thus, hypotheses tested were remarked. The consistency, reliability, validity, and level of significance are satisfactorily measured and confirmed through partial least square structural equation modelling; therefore, the outcomes of the study are dependable. Extending the research to examine the influence of work integrated learning on graduate employability and the role of the fourth industrial revolution skillset in disciplines beyond engineering could help higher education better understand the role of the fourth industrial revolution skillset. Therefore, prepare higher education students for employment in the future.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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